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CEMRC Ambient Air Studies May Ease Concerns over Pu in WIPP Exhaust Air

Recently, ^{239,240}Pu was detected for the first time in air samples collected from the WIPP exhaust shaft. Even though the amount of ^{239,240}Pu was exceedingly small (~5 to 10 mBq of ^{239,240}Pu in a quarterly composite), one might expect concerns to be raised over the release of any radioactive material--no matter how small the amount--from the facility. Data collected as part of an ongoing ambient air study, which is major part of CEMRC's WIPP environmental monitoring (WIPP EM) program, may help ease any such concerns.

The samples of WIPP exhaust air in which the ^{239,240}Pu was detected were collected with a fixed air sampler (FAS) in the second calendar quarter of 2003. Results from the WIPP EM ambient air studies have recently become available, and these data were examined to determine whether the apparent release of ^{239,240}Pu from the WIPP could be detected in ambient air samples matched to that same time period. This brief report summarizes the results of that comparison.

Background and Methods

Since the inception of the WIPP-EM program, samples of aerosol particles in ambient air have been collected for selected target radionuclides using high-volume samplers ("hivols," flow rate ~1.13 m^3 min^{-1}). Three stations have been used for these studies (1) On Site, which is on the WIPP premises proper and ~0.1 km northwest (climatologically downwind) from the WIPP exhaust shaft, (2) Near Field, located ~1 km northwest of the facility; and (3) Cactus Flats, a reference site established ~19 km southeast (upwind) of the WIPP. Each of these stations has supported a hivol sampler for collecting total suspended particulate (TSP) matter. Near Field and Cactus Flats stations also supported a second sampler collecting particulate matter less than 10 μm aerodynamic equivalent diameter (PM_{10}), but the PM_{10} sampling was terminated in December 2000 for budgetary reasons.

Results of the CEMRC ambient aerosols studies have shown that the activity of ^{239,240}Pu tracked the concentration of aluminum, an element often used as an indicator of mineral dust (Arimoto et al., 2002). The data from the study showed that peaks in the concentrations of both ^{239,240}Pu and Al occurred in the spring, which well known to be the time of year when winds are often strong and dust storms most common. One main conclusion of that study, published in *Health Physics*, was that the Pu/Al relationship was driven by the resuspension of soil particles previously contaminated with fallout from nuclear weapons tests. More relevant to evaluating plutonium releases from the WIPP, that study also showed that the activities of ^{239,240}Pu at the On Site station tracked those at the other

sites and that the ^{239,240}Pu activities at On Site were comparable to, if not lower than, those at the other stations.

The sampling and analytical methods used for CEMRC ambient aerosol studies have been described in a series of annual reports from the Center as well as in the *Health Physics* paper referenced above. Briefly, the samples for the radionuclide studies are collected on 20 x 25 cm A/E™ glass-fiber filters. The high-volume samples are analyzed for ^{239,240}Pu and other radionuclides following 4 hr of heating in a muffle furnace at 500° C, which drives off organics; dissolution of the material on the filters using strong acids (HF, HCl and $HClO_4$,); and multiple precipitation, co-precipitation, and ion-exchange and/or extraction chromatography steps. The nuclides of interest were precipitated with LaF_3, deposited onto filters, mounted on planchettes, and counted using an Oxford Oasis alpha spectroscopy system. Data are reported here as activity concentrations, that is, as Bq m^{-3}.

Results

A timeseries plot shows that the previously documented seasonal cycle of ^{239,240}Pu activity concentrations, with pronounced springtime peaks, has persisted throughout the course of the study. Closer inspection of the figure shows that ^{239,240}Pu activities in the On Site samples for the second calendar quarter of 2003 were entirely consistent with prior results. That is, there was no apparent increase in the activity of this radionuclide at the On Site Station relative to the other two stations during this period of time. A summary of the ^{239,240}Pu activity concentrations for the ambient air samples collected during the second quarter of 2003 is presented in Table 1.

Table 1 ^{239,240}Pu Activity Concentrations in Ambient Aerosol Samples

Midpoint of Sampling Interval	Station		
	On Site	Near Field	Cactus Flats
14 April 2003	1.82E-08 ± 1.25E-09*	2.45E-08 ± 1.46E-09	2.02E-08 ± 1.36E-09
20 May 2003	2.19E-08 ± 1.48E-09	2.01E-08 ± 1.64E-09	2.64E-08 ± 1.93E-09
17 June 2003	1.49E-08 ± 1.39E-09	1.22E-08 ± 1.27E-09	1.21E-08 ± 1.25E-09

*Activity concentration in Bq m^{-3} ± standard deviation

In addition to the fact that the ^{239,240}Pu concentrations in On Site samples were not elevated compared with those at the two other stations, the timeseries plot also shows that the data for all stations were completely in line with values observed during the spring seasons of prior years (which it may be noted also include data collected before the WIPP began receiving waste). Finally, it can be seen that the ^{239,240}Pu activity concentrations at all stations decreased rapidly after the second quarter ended, showing that there was no remnant activity of this nuclide evident, even at the On Site station.

In summary, this comparison of the data for the second quarter of 2003 vs. long-term record shows convincingly that there was no detectable increase of ^{239,240}Pu during the period of concern, even in aerosols collected approximately 100 m from the WIPP exhaust shaft. From a broader perspective, these results demonstrate the value in CEMRC's strategy for quantifying radionuclide activities below

regulatory limits and in maintaining a long-term record of ambient aerosol data, which can be used to evaluate transient events seen in the FAS data.

Literature Cited

Arimoto, R., T. Kirchner, J. Webb, M. Conley, B. Stewart, D. Schoep, and M..Walthall, ^{239,240}Pu and Inorganic Substances in Aerosols from the Vicinity of the Waste Isolation Pilot Plant: The Importance of Resuspension, *Health Physics*, 83, 456-470, 2002.

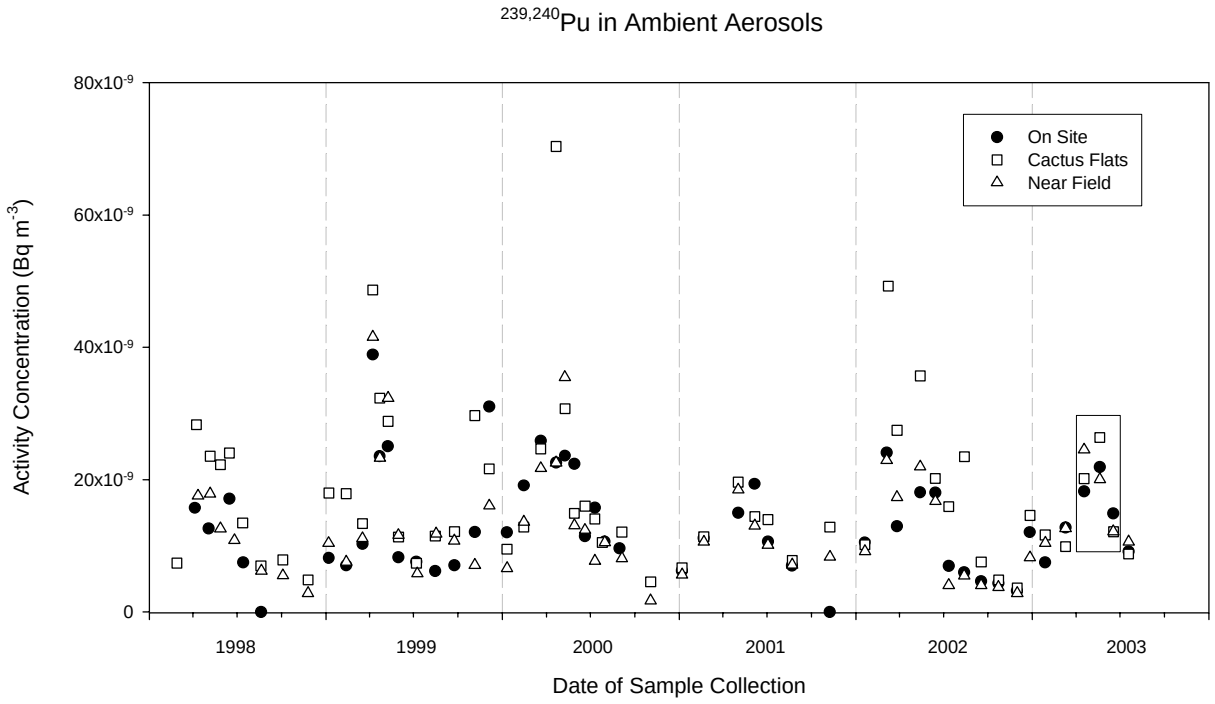

Figure 1. ^{239,240}Pu activity concentrations in ambient air samples collected from three stations for the CEMRC WIPP-EM program. Samples collected in the second calendar quarter of 2003 are enclosed in a rectangle.